

Neo-Natal Anæsthesia

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As the ages of the patients concerned may vary from a matter of hours to weeks, and, as feeding difficulties have usually rendered them underweight, it will be appreciated that these factors, when reinforced perhaps by vomiting and increased liability to respiratory infection, make anæsthesia in infants one of the major problems to be faced in anæsthetic practice.

When operation is not a matter of urgency, as for instance in hare-lip, then operation should, if possible, only be undertaken in mild weather, preferably during the summer months, when the incidence of respiratory infection is at its lowest level.

With regard to pre-operative care, the babies should be nursed in a warm sunny cubicle, and, if possible, have a separate nursing staff. The chest, nose, throat, and ears are carefully checked, and any abnormal physical signs, such as a rise in temperature or naso-pharyngeal infection are absolute contra-indications to operation, except in emergency cases. If dehydration is marked, an intravenous drip should be running. In this respect hyaluronidase has proved quite useful for hypodermoclysis.

In connection with diet, if feeding is not impossible, due to the condition present, the baby continues with its normal diet until the last feed before operation. The last feed is diluted with an equal quantity of 10 per cent. glucose and only half of the usual quantity is given. An interval of two to three hours elapses before operation. A similar feed is given after operation. The glucose insures that the liver will be well bolstered against the toxic effects of the anæsthetic.

In the cases of hare-lip the infants will, of course, have been treated for anæmia and brought up to weight by careful feeding.

Premedication consists of atropine alone, as any respiratory depression is dangerous, the dose being 1-200th to 1-150th grain, depending on the size of the infant. With the bigger infants .07 gramme of sodium soneryl may be given if the infant is very restless. Where obstruction in the gut is present a small stomach tube should be in position.

The safest anæsthetic agent in neo-natal work appears to be ether, delivered with a liberal supply of oxygen. Ethyl chloride should never be used, as it is a potent cardio-respiratory depressant.

The ether, when given with nitrous oxide and oxygen and *followed* by $\frac{1}{2}$ per cent. novocaine infiltration of the abdominal wall gives, in our view, the best available anæsthetic, both from the baby's and the surgeon's point of view.

Clothing during operation is important :—It is essential that these babies must not become too hot during operation. A baby's heat regulating mechanism is both highly unstable and sensitive, and high temperatures in babies are easily provoked. The heat-regulating centre is depressed during anæsthesia, but recovers rapidly at its conclusion. With the application of excessive external heat, the baby's temperature may rise to 105° or 108° Fahrenheit. In addition, atropine raises the metabolic rate and tends to abolish sweating. For these reasons, therefore, it is better to have the baby on the cool side rather than to be too warm. It should be stripped down before induction and simply covered with a linen sheet or towel. Mackintosh sheeting should never be used.

When we consider the actual technique of anæsthesia, there are three requisites for the ideal administration.

The first requisite is liberal oxygenation through a perfect airway, thereby ensuring the absence of anoxia, protection against the toxic effects of the anæsthetic agent, and the avoidance of congestion and bleeding.

The second requisite is the avoidance of any form of increased mechanical effort. This covers both phases of respiration and will be due to obstruction of the airway.

Thirdly, excessive building up of carbon dioxide is to be avoided, as this is a toxic substance, causing additional respiratory effort, a raised blood pressure, and increased bleeding.

To turn for a moment to the induction and maintenance of the anæsthetic, we have given up the use of the "rag and bottle ether" method, for, although it is very good, we consider it is too clumsy to use whilst working so close to the surgeons, and, besides, the vapours the baby will inhale are much too chilly and add to the risk of respiratory infection. The method now adopted is to use the Boyle machine with the semi-closed attachment and the rebreathing bag closed off. The rubber mask is at all times held about one inch from the face, so that there is no rebreathing, and the baby breathes anæsthetic mixture and air. The smallest rubber mask made has a capacity of 90 c.c. and if the mask were held close to the face this would be a great addition of dead space to a small tidal air of about 180 c.c.

The baby then is rendered unconscious with nitrous oxide and air and oxygen is added up to 40 per cent. with ether until a moderate depth of anæsthesia is reached. When this stage is reached the surgeon may now infiltrate skin and abdominal muscle with $\frac{1}{2}$ to 1 per cent. novocaine and adrenalin. This local anæsthetic helps greatly in the relaxation of the abdominal wall and also limits hæmorrhage. We have now come to the conclusion that it is better to induce general anæsthesia from the start, as it is very difficult to induce general anæsthesia half way through an operation under local, when the infant has already had a pull on its mesentery, and is struggling violently to escape from the whole business. The local anæsthetic is therefore used as an adjunct to the general anæsthetic, and not vice versa, as with anæsthesia in adults.

If, as may happen during the induction for a hare-lip operation, the baby develops cardio-vascular collapse, becoming very white and shocked, it should be

returned to the ward and operation deferred for three months. This collapse is very liable to occur when ethyl chloride is used, and is not, in my opinion, in any way due to an idiosyncrasy on the part of the infant.

During the operation great care must be taken to see that the infant does not become too lightly anæsthetised, as this is probably the most common cause of trouble and actual disaster. One should always, if in doubt, err on the side of depth of anæsthesia, because if one is anæsthetising too timidly the anæsthetic will become light, vomiting or laryngeal spasm, or both, may occur, to be followed in an amazingly short space of time by the most frightening cyanosis, which the baby will tolerate very badly. The same sequence of events, in a delicately balanced nervous mechanism, is liable to occur if an airway is used in these infants. These airways are liable to cause copious salivation in an infant, leading to obstruction and perhaps again spasm of the larynx.

In the operation for hare-lip, usually undertaken at from eight to twelve weeks, the induction of anæsthesia is carried out in a similar manner to that mentioned and when a moderately deep plane of anæsthesia has been reached, a Magill endotracheal tube, size 0 or 00, is passed orally with the aid of a laryngoscope. Extreme gentleness is essential, and no bruising of the larynx or cords is permitted. If bruising does occur through passing a tube in light anæsthesia, it is probably safer to abandon the operation for some weeks, as laryngeal œdema and obstruction are almost certain to occur post-operatively.

It should be remembered, when considering how long the operation should continue in these infants, that the infant's larynx is extremely tiny, and that the passage of even an adequately-sized tube cuts the diameter of the trachea by about one-third. That is to say, some important degree of respiratory obstruction is present before the operation even begins.

The tubes used are either of stiff rubber, or are armoured with wire to prevent kinking. None of them is really satisfactory, as the rubber is too thick, or the tube kinks, and even when the armoured tube is stitched to the tongue or the gag, it tends to arch up and embarrass the surgeon.

The tube is brought out of the mouth and is connected by a T piece or a sidevent to the supply of anæsthetic. No rebreathing is permitted here either, and only the lightest anæsthesia is required during the operation.

The post-operative anæsthetic complications are: firstly, bronchitis or bronchopneumonia, with or without atelectasis—diffuse or massive; and secondly, in the case of hare-lip surgery, laryngeal œdema, which is recognised a few hours after operation by stridor, and may go on to gross obstruction necessitating tracheotomy. This latter condition must always be due to rough handling during intubation.

Anæsthesia has been described as a journey, starting with consciousness and ending in death, a halt being called in that journey when the required depth of anæsthesia is reached. If it is remembered when working with infants that this journey may be very short and that every known anæsthetic accident and disaster may occur without the slightest warning, then, by taking the most meticulous care, it is hoped that the anæsthetic morbidity and mortality rates will still improve.